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P 73 Software Requirements and Prototype Development of a Web Application for Quality Assurance (QA) in Radiation Therapy- a QAlender

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Introduction: The Radiooncology Department of the University Hospital of Tübingen (UKT) operates six radiation treatment units in the main site in Tübingen and three hospital branches in the vicinity with one Linac on each site.

Today the complete technical QA is paper based according to the procedures regulated in e.g. DIN6847-5, DIN6847-6 and 6875-4. Every branch maintains a system of individual storage without a central database. This local usage of file-based documents (e.g. MS-Excel files) does not permit parallel access or interpretability of data. The current paper based administration is time consuming and inefficient.

To comply with future requirements of an efficient and practicable workflow, the QA of all radiation treatment units has to be coordinated and maintained centrally. Therefore the development and implementation of a centralized QA management system, which is easily accessible from all internal and external treatment units is essential. Thereto web based solutions allow for the use of mobile devices and efficient integration into an existing infrastructure.

Goal of this project is to design a feasible software architecture in order to optimize and simplify the current work flows which should at the same time be easily expandable to future challenges.

Material and methods: The technical demands are determined by the infrastructural and organizational structure of the UKT:

- The basic installation of the system is adaptable to different end devices
- Parallel access is possible
- Access is independent of the device (e.g. fat client or tablet)
- Check documents are presentable on web based documents
- Result data is saved in a central database
- Calendaric overview of executed and imminent QA checks for each treatment unit and graphical illustration of the follow-up interval
- Export of the results to a PDF-A File
- Storage of check files and raw data
- Currently MS-Windows is the standard operating system on clients in the UKT
- Applications and servers are virtualized via a citrix solution

The required web application consists of a central server based on a database and a web server with the corresponding application software (Fig. 1). Data is accessed via http protocol from clients with a standard web browser. For this kind of software architecture numerous framework solutions based on freeware already exist on the market [1]. The data model could be realized with the freeware database PostgreSQL. A Free Apache Tomcat Web Server could serve as a web server. PHP could be used for the application logic. All components could be easily integrated into the present software architecture and could be installed on Windows or Linux Platforms both. Therefore the usage of mobile devices via WLAN is possible independently of their operating systems since the server is accessible by generally available browsers.

As a first step the rationalization effect of such a system should be analyzed. The main effect will be a major saving of time for the staff and a much better traceability of the data by the use of Single sign on, standard access permissions and automated logging. The data and the results of QA checks will always be available from inside and outside of the UKT. This will lead to a much better performance due to intelligent user management and suitable input interfaces. Future integration of existing software such as digitized dose quality assurance into this concept is also possible. In this case three requirements have to be considered: Launching an external application, passing parameters and importing the results. All of them need the development of specific data and user interfaces. Integrating applications into an existing system is a well-known issue in healthcare information systems which is solved by open standards and middleware [2,3]. This is already part of the initial system design.

Outlook: Future developments requiring special applications such as dynamic QA measurements arise from modern and complex radiation treatment techniques such as IMRT and VMAT require. Therefore a future proof QA system must provide an open design to be extensible for new modules for instance:

- individually designed web based input interfaces instead of check documents
- Directly editable and not hardcoded input interfaces. Data should be imported in a predefined format from a precise import directory
- Automatic data import from DICOM image files via a DICOM interface. The field information should be extracted from the DICOM Header file automatically and can be compared with the automatically analyzed data of the DICOM image. The data should be presented in a pdf report.
- Automatic analysis of dynamic “DICOM Movies”.

Results: The implementation of a web based portal QA solution will lead to a high acceptance of the staff as the usage of commonly known standard software (e.g. web browser) allows intuitive handling. In the daily use a significant simplification of the workflow and performance enhancement can be achieved by easy access to the check documents.

As the data is now saved in a database it can easily be processed and long-term trends can be displayed. Therefore possible errors can be detected much easier and earlier.

By the usage of time stamps and user authentication procedures and user responsibilities are comprehensibly documented.

As the software is browser-based, integration into an existing software environment is not critical. As only technical QA data is processed, no further data security measures are necessary. A certification as a medical product is not required.

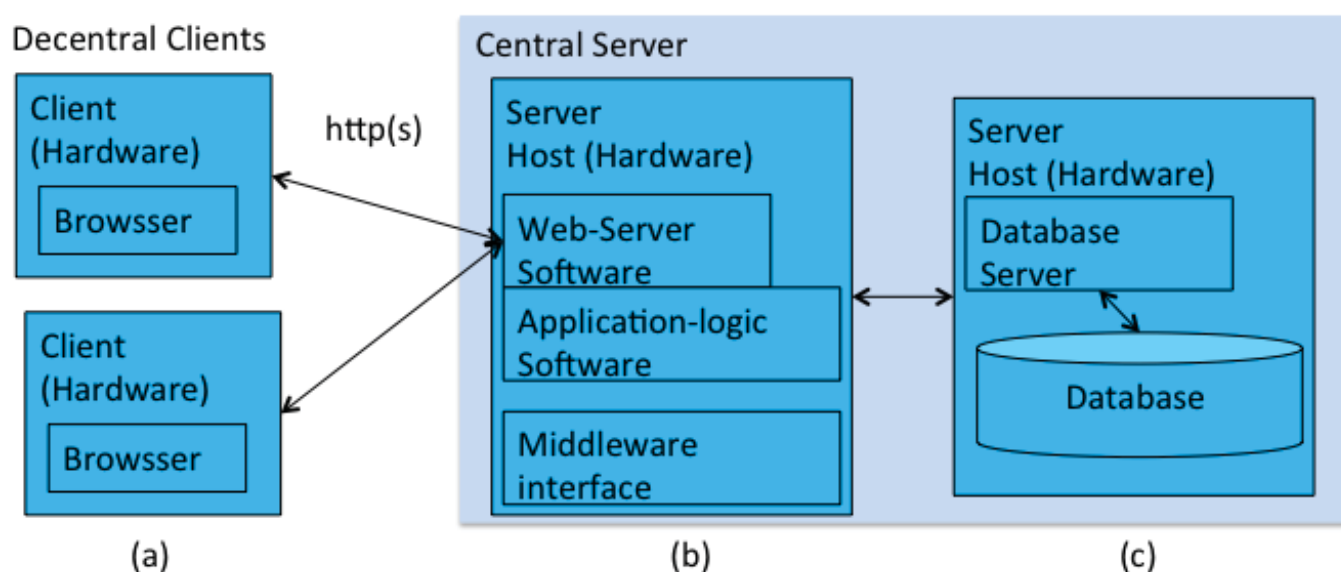


Fig. 1: In web based applications decentral clients (a) access a central server via standard http(s) protocol. Communication and application logic as well as the interfaces are hosted on a special hardware (b) from which the separate database server is accessed (c).

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